

METHOD AND SYSTEM FOR USING A VOICE CHANNEL WITH A DATA SERVICE

This application claims priority to United States Provisional Patent Application Serial Number 60/256,091, filed on December 15, 2000.

5 Background of the Invention

The present invention relates generally to telecommunications. More particularly, the invention relates to a method and system for obtaining information from a voice channel while using a data service in a mobile telecommunications environment.

10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
145
150
155
160
165
170
175
180
185
190
195
200
205
210
215
220
225
230
235
240
245
250
255
260
265
270
275
280
285
290
295
300
305
310
315
320
325
330
335
340
345
350
355
360
365
370
375
380
385
390
395
400
405
410
415
420
425
430
435
440
445
450
455
460
465
470
475
480
485
490
495
500
505
510
515
520
525
530
535
540
545
550
555
560
565
570
575
580
585
590
595
600
605
610
615
620
625
630
635
640
645
650
655
660
665
670
675
680
685
690
695
700
705
710
715
720
725
730
735
740
745
750
755
760
765
770
775
780
785
790
795
800
805
810
815
820
825
830
835
840
845
850
855
860
865
870
875
880
885
890
895
900
905
910
915
920
925
930
935
940
945
950
955
960
965
970
975
980
985
990
995
1000
1005
1010
1015
1020
1025
1030
1035
1040
1045
1050
1055
1060
1065
1070
1075
1080
1085
1090
1095
1100
1105
1110
1115
1120
1125
1130
1135
1140
1145
1150
1155
1160
1165
1170
1175
1180
1185
1190
1195
1200
1205
1210
1215
1220
1225
1230
1235
1240
1245
1250
1255
1260
1265
1270
1275
1280
1285
1290
1295
1300
1305
1310
1315
1320
1325
1330
1335
1340
1345
1350
1355
1360
1365
1370
1375
1380
1385
1390
1395
1400
1405
1410
1415
1420
1425
1430
1435
1440
1445
1450
1455
1460
1465
1470
1475
1480
1485
1490
1495
1500
1505
1510
1515
1520
1525
1530
1535
1540
1545
1550
1555
1560
1565
1570
1575
1580
1585
1590
1595
1600
1605
1610
1615
1620
1625
1630
1635
1640
1645
1650
1655
1660
1665
1670
1675
1680
1685
1690
1695
1700
1705
1710
1715
1720
1725
1730
1735
1740
1745
1750
1755
1760
1765
1770
1775
1780
1785
1790
1795
1800
1805
1810
1815
1820
1825
1830
1835
1840
1845
1850
1855
1860
1865
1870
1875
1880
1885
1890
1895
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
2080
2085
2090
2095
2100
2105
2110
2115
2120
2125
2130
2135
2140
2145
2150
2155
2160
2165
2170
2175
2180
2185
2190
2195
2200
2205
2210
2215
2220
2225
2230
2235
2240
2245
2250
2255
2260
2265
2270
2275
2280
2285
2290
2295
2300
2305
2310
2315
2320
2325
2330
2335
2340
2345
2350
2355
2360
2365
2370
2375
2380
2385
2390
2395
2400
2405
2410
2415
2420
2425
2430
2435
2440
2445
2450
2455
2460
2465
2470
2475
2480
2485
2490
2495
2500
2505
2510
2515
2520
2525
2530
2535
2540
2545
2550
2555
2560
2565
2570
2575
2580
2585
2590
2595
2600
2605
2610
2615
2620
2625
2630
2635
2640
2645
2650
2655
2660
2665
2670
2675
2680
2685
2690
2695
2700
2705
2710
2715
2720
2725
2730
2735
2740
2745
2750
2755
2760
2765
2770
2775
2780
2785
2790
2795
2800
2805
2810
2815
2820
2825
2830
2835
2840
2845
2850
2855
2860
2865
2870
2875
2880
2885
2890
2895
2900
2905
2910
2915
2920
2925
2930
2935
2940
2945
2950
2955
2960
2965
2970
2975
2980
2985
2990
2995
3000
3005
3010
3015
3020
3025
3030
3035
3040
3045
3050
3055
3060
3065
3070
3075
3080
3085
3090
3095
3100
3105
3110
3115
3120
3125
3130
3135
3140
3145
3150
3155
3160
3165
3170
3175
3180
3185
3190
3195
3200
3205
3210
3215
3220
3225
3230
3235
3240
3245
3250
3255
3260
3265
3270
3275
3280
3285
3290
3295
3300
3305
3310
3315
3320
3325
3330
3335
3340
3345
3350
3355
3360
3365
3370
3375
3380
3385
3390
3395
3400
3405
3410
3415
3420
3425
3430
3435
3440
3445
3450
3455
3460
3465
3470
3475
3480
3485
3490
3495
3500
3505
3510
3515
3520
3525
3530
3535
3540
3545
3550
3555
3560
3565
3570
3575
3580
3585
3590
3595
3600
3605
3610
3615
3620
3625
3630
3635
3640
3645
3650
3655
3660
3665
3670
3675
3680
3685
3690
3695
3700
3705
3710
3715
3720
3725
3730
3735
3740
3745
3750
3755
3760
3765
3770
3775
3780
3785
3790
3795
3800
3805
3810
3815
3820
3825
3830
3835
3840
3845
3850
3855
3860
3865
3870
3875
3880
3885
3890
3895
3900
3905
3910
3915
3920
3925
3930
3935
3940
3945
3950
3955
3960
3965
3970
3975
3980
3985
3990
3995
4000
4005
4010
4015
4020
4025
4030
4035
4040
4045
4050
4055
4060
4065
4070
4075
4080
4085
4090
4095
4100
4105
4110
4115
4120
4125
4130
4135
4140
4145
4150
4155
4160
4165
4170
4175
4180
4185
4190
4195
4200
4205
4210
4215
4220
4225
4230
4235
4240
4245
4250
4255
4260
4265
4270
4275
4280
4285
4290
4295
4300
4305
4310
4315
4320
4325
4330
4335
4340
4345
4350
4355
4360
4365
4370
4375
4380
4385
4390
4395
4400
4405
4410
4415
4420
4425
4430
4435
4440
4445
4450
4455
4460
4465
4470
4475
4480
4485
4490
4495
4500
4505
4510
4515
4520
4525
4530
4535
4540
4545
4550
4555
4560
4565
4570
4575
4580
4585
4590
4595
4600
4605
4610
4615
4620
4625
4630
4635
4640
4645
4650
4655
4660
4665
4670
4675
4680
4685
4690
4695
4700
4705
4710
4715
4720
4725
4730
4735
4740
4745
4750
4755
4760
4765
4770
4775
4780
4785
4790
4795
4800
4805
4810
4815
4820
4825
4830
4835
4840
4845
4850
4855
4860
4865
4870
4875
4880
4885
4890
4895
4900
4905
4910
4915
4920
4925
4930
4935
4940
4945
4950
4955
4960
4965
4970
4975
4980
4985
4990
4995
5000
5005
5010
5015
5020
5025
5030
5035
5040
5045
5050
5055
5060
5065
5070
5075
5080
5085
5090
5095
5100
5105
5110
5115
5120
5125
5130
5135
5140
5145
5150
5155
5160
5165
5170
5175
5180
5185
5190
5195
5200
5205
5210
5215
5220
5225
5230
5235
5240
5245
5250
5255
5260
5265
5270
5275
5280
5285
5290
5295
5300
5305
5310
5315
5320
5325
5330
5335
5340
5345
5350
5355
5360
5365
5370
5375
5380
5385
5390
5395
5400
5405
5410
5415
5420
5425
5430
5435
5440
5445
5450
5455
5460
5465
5470
5475
5480
5485
5490
5495
5500
5505
5510
5515
5520
5525
5530
5535
5540
5545
5550
5555
5560
5565
5570
5575
5580
5585
5590
5595
5600
5605
5610
5615
5620
5625
5630
5635
5640
5645
5650
5655
5660
5665
5670
5675
5680
5685
5690
5695
5700
5705
5710
5715
5720
5725
5730
5735
5740
5745
5750
5755
5760
5765
5770
5775
5780
5785
5790
5795
5800
5805
5810
5815
5820
5825
5830
5835
5840
5845
5850
5855
5860
5865
5870
5875
5880
5885
5890
5895
5900
5905
5910
5915
5920
5925
5930
5935
5940
5945
5950
5955
5960
5965
5970
5975
5980
5985
5990
5995
6000
6005
6010
6015
6020
6025
6030
6035
6040
6045
6050
6055
6060
6065
6070
6075
6080
6085
6090
6095
6100
6105
6110
6115
6120
6125
6130
6135
6140
6145
6150
6155
6160
6165
6170
6175
6180
6185
6190
6195
6200
6205
6210
6215
6220
6225
6230
6235
6240
6245
6250
6255
6260
6265
6270
6275
6280
6285
6290
6295
6300
6305
6310
6315
6320
6325
6330
6335
6340
6345
6350
6355
6360
6365
6370
6375
6380
6385
6390
6395
6400
6405
6410
6415
6420
6425
6430
6435
6440
6445
6450
6455
6460
6465
6470
6475
6480
6485
6490
6495
6500
6505
6510
6515
6520
6525
6530
6535
6540
6545
6550
6555
6560
6565
6570
6575
6580
6585
6590
6595
6600
6605
6610
6615
6620
6625
6630
6635
6640
6645
6650
6655
6660
6665
6670
6675
6680
6685
6690
6695
6700
6705
6710
6715
6720
6725
6730
6735
6740
6745
6750
6755
6760
6765
6770
6775
6780
6785
6790
6795
6800
6805
6810
6815
6820
6825
6830
6835
6840
6845
6850
6855
6860
6865
6870
6875
6880
6885
6890
6895
6900
6905
6910
6915
6920
6925
6930
6935
6940
6945
6950
6955
6960
6965
6970
6975
6980
6985
6990
6995
7000
7005
7010
7015
7020
7025
7030
7035
7040
7045
7050
7055
7060
7065
7070
7075
7080
7085
7090
7095
7100
7105
7110
7115
7120
7125
7130
7135
7140
7145
7150
7155
7160
7165
7170
7175
7180
7185
7190
7195
7200
7205
7210
7215
7220
7225
7230
7235
7240
7245
7250
7255
7260
7265
7270
7275
7280
7285
7290
7295
7300
7305
7310
7315
7320
7325
7330
7335
7340
7345
7350
7355
7360
7365
7370
7375
7380
7385
7390
7395
7400
7405
7410
7415
7420
7425
7430
7435
7440
7445
7450
7455
7460
7465
7470
7475
7480
7485
7490
7495
7500
7505
7510
7515
7520
7525
7530
7535
7540
7545
7550
7555
7560
7565
7570
7575
7580
7585
7590
7595
7600
7605
7610
7615
7620
7625
7630
7635
7640
7645
7650
7655
7660
7665
7670
7675
7680
7685
7690
7695
7700
7705
7710
7715
7720
7725
7730
7735
7740
7745
7750
7755
7760
7765
7770
7775
7780
7785
7790
7795
7800
7805
7810
7815
7820
7825
7830
7835
7840
7845
7850
7855
7860
7865
7870
7875
7880
7885
7890
7895
7900
7905
7910
7915
7920
7925
7930
7935
7940
7945
7950
7955
7960
7965
7970
7975
7980
7985
7990
7995
8000
8005
8010
8015
8020
8025
8030
8035
8040
8045
8050
8055
8060
8065
8070
8075
8080
8085
8090
8095
8100
8105
8110
8115
8120
8125
8130
8135
8140
8145
8150
8155
8160
8165
8170
8175
8180
8185
8190
8195
8200
8205
8210
8215
8220
8225
8230
8235
8240
8245
8250
8255
8260
8265
8270
8275
8280
8285
8290
8295
8300
8305
8310
8315
8320
8325
8330
8335
8340
8345
8350
8355
8360
8365
8370
8375
8380
8385
8390
8395
8400
8405
8410
8415
8420
8425
8430
8435
8440
8445
8450
8455
8460
8465
8470
8475
8480
8485
8490
8495
8500
8505
8510
8515
8520
8525
8530
8535
8540
8545
8550
8555
8560
8565
8570
8575
8580
8585
8590
8595
8600
8605
8610
8615
8620
8625
8630
8635
8640
8645
8650
8655
8660
8665
8670
8675
8680
8685
8690
8695
8700
8705
8710
8715
8720
8725
8730
8735
8740
8745
8750
8755
8760
8765
8770
8775
8780
8785
8790
8795
8800
8805
8810
8815
8820
8825
8830
8835
8840
8845
8850
8855
8860
8865
8870
8875
8880
8885
8890
8895
8900
8905
8910
8915
8920
8925
8930
8935
8940
8945
8950
8955
8960
8965
8970
8975
8980
8985
8990
8995
9000
9005
9010
9015
9020
9025
9030
9035
9040
9045
9050
9055
9060
9065
9070
9075
9080
9085
9090
9095
9100
9105
9110
9115
9120
9125
9130
9135
9140
9145
9150
9155
9160
9165
9170
9175
9180
9185
9190
9195
9200
9205
9210
9215
9220
9225
9230
9235
9240
9245
9250
9255
9260
9265
9270
9275
9280
9285
9290
9295
9300
9305
9310
9315
9320
9325
9330
9335
9340
9345
9350
9355
9360
9365
9370
9375
9380
9385
9390
9395
9400
9405
9410
9415
9420
9425
9430
9435
9440
9445
9450
9455
9460
9465
9470
9475
9480
9485
9490
9495
9500
9505
9510
9515
9520
9525
9530
9535
9540
9545
9550
9555
9560
9565
9570
9575
9580
9585
9590
9595
9600
9605
9610
9615
9620
9625
9630
9635
9640
9645
9650
9655
9660
9665
9670
9675
9680
9685
9690
9695
9700
9705
9710
9715
9720
9725
9730
9735
9740
9745
9750
9755
9760
9765
9770
9775
9780
9785
9790
9795
9800
9805
9810
9815
9820
9825
9830
9835
9840
9845
9850
9855
9860
9865
9870
9875
9880
9885
9890
9895
9900
9905
9910
9915
9920
9925
9930
9935
9940
9945
9950
9955
9960
9965
9970
9975
9980
9985
9990
9995
10000
10005
10010
10015
10020
10025
10030
10035
10040
10045
10050
10055
10060
10065
10070
10075
10080
10085
10090
10095
10100
10105
10110
10115
10120
10125
10130
10135
10140
10145
10150
10155
10160
10165
10170
10175
10180
10185
10190
10

hotel. However, if users do not know their latitude and longitude information, they cannot make full use of the location-based service (LBS).

Known location determination technologies include Global Positioning Systems ("GPS") and network based methods. GPS based methods use signals generated from 24 satellites orbiting the earth to determine the position of a MU, accurate to a few meters. A significant disadvantage of GPS solutions is that they require that the mobile device being located to be equipped with GPS hardware.

Known network based methods, e.g., time difference of arrival (TDOA), angle of arrival (AOA), and location pattern matching systems, are an alternative to GPS. These methods generally involve triangulating the radio emission of the mobile unit or using RF multipath "fingerprinting" to identify the most likely position of the radiating source. There are believed to be performance advantages to the multipath method over triangulation. In urban environments, an accuracy of 30 meters has been achieved. While less accurate than GPS, network based methods work readily on existing phones.

However, these known location determining platforms are dependent on the deployment of either new end-user equipment (in GPS based systems), or Mobile Locating Centers (MLC, in network based systems). MLCs are the data centers required to provide triangulation services and RF multipath fingerprinting, or other location services external to the mobile unit. While MLCs are being deployed to make locating a MU more practical, network operators are not presently required to have such locating infrastructure in place.

Also, as wireless applications begin to provide a wide array of data services to mobile users, there has arisen a need to authenticate a user before providing selective data services.

Some of these services allow the user to view or manipulate private and/or financial information. For instance, a wireless application might allow a user to trade stocks, receive bank account information, or even transfer funds from one account to another, using a mobile unit. In such instances, service providers want to ensure that the owner of the funds/account is actually the individual that is making the request, and not someone else who happened to find the mobile unit from which the request is being made.

Known ways of authenticating a user include using a password or personal identification number (PIN), collectively referred to herein as passcodes. Passcodes, however, may be forgotten. Often, users write them down so as not to forget them. When they are written down, passcodes may be easily copied or stolen if found. Also, passcodes are often deduced from known information regarding an individual. For instance, a common passcode is to use a child's name or birthday. If a thief knows this information regarding a user, the thief may more easily determine what the user's passcode may be. A better way of performing authentication that is not susceptible to loss or theft is therefore needed.

Summary of the Invention

In one aspect, the invention is embodied in a method for obtaining data from a voice channel. An application using a data channel is initiated. A user speaks over a voice channel. The voice communications are converted into application data. The application data is provided to the application.

In another embodiment, the invention provides a location of a mobile unit. A first data file corresponding to a first set of localities is loaded. The user's voice is compared to the first data file to determine a first selected locality. A second data file corresponding to a second set of

localities is loaded. The second set of localities are geographically located within the selected locality. These steps are repeated until a precise location is determined.

In some embodiments, a locality may be a landmark.

In another aspect, the invention is embodied in a system for providing voice channel
5 services in a telecommunications network. There is a processor and a memory containing computer readable instructions that cause the system to perform a set of steps. The system initiates an application using a data channel. The system receives voice input spoken by a user over a voice channel. The system converts the voice communication to application data, and provides the application data to the application.

In another aspect, the invention is embodied in a system for refining the location of a mobile unit. There is a processor and a memory containing computer readable instructions that cause the system to perform a set of steps. The system loads a first data file corresponding to a first set of localities. The system receives a first voice input from a user and compares it to the first data file to determine a first selected locality. The system loads a second data file corresponding to a second set of localities. Each of the localities in the second set are geographically located at least partially within the selected locality. These steps are repeated until a location is determined.

Brief Description of Drawings

Figure 1A shows a mobile telecommunications system in accordance with the invention.

Figure 1B shows a server configured according to an embodiment of the invention.

Figure 2A shows a timeline of data channel and voice channel use according to an embodiment of the invention.

Figure 2B shows a data flow diagram for an embodiment of the invention.

Figure 2C shows a flowchart for an aspect of the invention.

Figure 3 shows a flowchart of a method for determining a location in accordance with the invention.

5 Figure 4 shows a geographic representation of an embodiment of the invention.

Figure 5 shows a flowchart of a method for performing voice authentication in accordance with the invention.

Detailed Description of Preferred Embodiments

10 The present invention provides a method and system for accepting input from a voice channel for use by a data service, in a mobile telecommunications environment. Using the present invention, in a mobile telecommunications environment data may be input through a voice channel and passed to a data service that makes use of a data channel, while the data channel remains assigned to a mobile unit.

15 With reference to Fig. 1A, in a mobile telecommunications environment adapted to perform location-based services, there are one or more communications antennas (base units) 101-107, mobile units (MU) 111-119, and a voice services server 121. Mobile units 111-119 communicate wirelessly with communications antennas 101-107 using known means. Each antenna communicates with, either directly or indirectly, voice services server 121. The voice
20 services server is adapted to perform certain steps as described below. It should be apparent that the network topology shown in Fig. 1 is an example of a network topology that may be used, and is not meant as a limitation. More than one voice services server may be used. For instance, one

server may be used per voice application, or all voice applications may reside on one or more servers, depending on network usage and capacity.

With reference to Fig. 1B, the server 121 is shown in greater detail, as it is used in one embodiment of the invention. There is a processor 151 and a memory 153. In the memory is stored speech recognition software 155, speech synthesis software 157, voice authentication software 158, location information 159 including grammar files (discussed below), voice-geocoder 160, and geocoder 161.

Using the above or similar topology, the present invention may provide a mobile unit's location using voice-geocoding. Geocoding, generally, refers to the process of assigning X and Y coordinates to a location for purposes of plotting the location on a map. In the present invention, a voice-geocoding software module uses speech-to-text technology to convert spoken location information to computer readable data. The geocoder software module compares the computer readable data to a data library of location information and returns specific location information, such as latitude and longitude coordinates. The latitude and longitude coordinates may then be used in location-based services. A voice channel using the present invention may also provide user authentication while a user is utilizing a data service.

With reference to Fig. 2A, at a time T0 a user requests a data channel service via a MU. A data service may be a wireless web application such as the provisioning of stock quotes, movie showtimes, or the like, direct messaging services such as AT&T's 2-Way Text Messaging service, or other non-voice related services.

At a time T1, in response to the user's request for a data service, the telecommunications system assigns and opens a data channel with the user's MU, allowing the data service to

commence. At some point T2 during the data service, the data service requests input that, if not otherwise available to the data service, may be generated by the user's voice over a voice channel. In response to the request, the system temporarily suspends the data channel at time T3, but the system does not relinquish the data channel such that it could be assigned to another MU.

- 5 Optionally, provided the MU has the necessary hardware to maintain two open channels, the data channel may remain active while the voice channel is in use.

After the system suspends the data channel, the system assigns and establishes a voice channel with the MU at time T4. The user interacts with an entity via voice using the voice channel, generating data at time T5. The entity that the user interacts with may be any type of entity that can generate data for use with a data service. For instance, if the data service is a travel information service via a wireless web application, the entity may be a person such as a reservations operator for an airline or car rental agency. The operator may make a reservation for the user and send the reservation information to the data service. The data service may then continue to provide additional information to the user based on the reservation information, such as informing the user of special events at the travel location during the user's period of travel.

The entity may also be a computer system enabled with speech recognition technology. For instance, where the data service is a location-based service (LBS), and the system or MU is not equipped to autonomously provide the MU location (such as using GPS or triangulation), a user may provide his or her physical location to a computer using speech recognition, as described below. Upon speaking the user's location, the system translates the voice information to location data at time T5, and can send the user-provided location to the LBS. For instance, where an LBS is a friend finder service, the LBS may use the location information to locate any

of the user's friends that are nearby. Other data services may easily be envisioned that use data provided by voice.

After generating the data, the voice channel is terminated at time T6, and the data channel is reactivated at time T7. The data generated at time T5 is sent to the data service at time T8.

- 5 The data service may then continue providing data services at time T9, incorporating the information received. At some time after T9, the data channel is terminated at time T10 when the user has completed using the data service.

In some embodiments, the first data channel opened at time T1 may be terminated at time T3, and a second data channel may be opened at time T7. The data generated at time T5 may then be passed as input to the new data channel opened at time T7.

In a preferred embodiment, voice-geocode technology is used to identify a location of a mobile unit. The location determination engine may be automated, utilizing voice-recognition and text-to-speech technologies. Using a hierarchical database, the voice-geocode system can quickly and efficiently provide a geographical coordinate corresponding to the spoken location. The system may identify a location using a street address or an intersection of two streets. The voice-geocode architecture is universal and scalable. That is, the same architecture may be used for any geographic area, and for any number of MUs. The voice-geocode system may be implemented using the Java programming language in an Enterprise Java Beans (EJB) architecture. Integrated EJB components within the voice-geocode application server provide location services to external applications. Other programming languages may be used, for instance, PERL, C, Visual Basic, and the like.

With reference to the data flow diagram shown in Fig. 2B, a mobile locating center (MLC) 171 may provide location information of one or more MUs 177a-177d to other applications and/or data services 179. That is, upon request by a data service 179, the MLC provides the location of a MU, using any means available (e.g., GPS, TDOA, voice-geocode, etc.) for the requested MU. The MLC may receive GPS information from some MUs (e.g., MU 177a), or the MLC may receive location information from a TDOA system 173 or an AOA system 175. If a non-voice geocode system is available, or if the user wants to enter a location other than his or her present location, the MLC may receive the location information from a voice geocode module 174.

Using the embodiment shown in Fig. 2B, a single telecommunications system can accommodate MUs with different capabilities. That is, a telecommunications system can perform location services for MUs with and without GPS capabilities. Also, the same telecommunications system can perform location services for MUs located in areas with and without network-based location determination technologies, such as TDOA, AOA, and the like. In addition, the same telecommunications system can accommodate MUs without GPS and located in an area without network-based location determination capability, all transparent to the location-based application.

As shown in Fig. 2C, the MLC is configured with logic to determine the location of the MU based on the technology with which the specific MU and/or the MLC is enabled. The MLC initially receives a request for a MU location in step 181. If the MLC has previously received the MU's location within a predetermined amount of time, as determined in step 183, the MLC proceeds to output the location in step 197. Otherwise, the MLC queries in step 185 whether the

MU is GPS enabled. If the MU is GPS-enabled, the MLC gets the MU's GPS location information in step 187. If the MU is not GPS-enabled, the MLC queries in step 189 whether a network-based location determination method is available. If a network-based location system is available, the MLC gets the MU's location information from the network-based location system in step 191. If no network-based location system is available, the MLC initiates a voice channel with the MU in step 193, and proceeds to perform steps 201-231, as described below. Upon completion of steps 201-231, the MLC outputs the MU location in step 197.

The voice-geocoder module generally takes one argument, a MU's phone number, and returns a LAT/LON coordinate. Inside the voice-geocoder, voice-recognition and text-to-speech technologies are used to interrogate the user of the MU, determine the state, city, street, and address number or cross street. When the cross street or street number is offered, the voice-geocoder invokes another component, referred to herein as the geocoder, to determine if the proposed address is a valid location. The voice-geocoder converts a user's spoken location into text location information. The geocoder receives the text and converts the location into latitude and longitude coordinates by comparing the text location information to a database of possible locations, further described below. If the proposed address is not a valid location the user is prompted to re-enter the specific address, number or cross street so as to determine the proper coordinate.

Voice recognition software that may be used in the invention is Nuance, commercially available from Nuance Communications, located in Menlo Park, California. Text-to-speech software which may be used in the invention is FFAST TTS, commercially available from Fonix Corporation, located in Salt Lake City, Utah.

The voice-geocoder may operate using a drill-down hierarchy scheme. A system embodying the invention prompts a user for a high level description his or her location, e.g., the user's state. The system successively prompts the user for his or her location with more precision, e.g., city, street, etc. At each level, the voice recognition software compares the user's response to a grammar file containing information corresponding to the domain of allowable responses at that level. Hierarchies of different levels are possible, depending on the domain of possible locations.

In one embodiment of the invention, the area of possible locations is defined as the United States. In such an embodiment, a four-level hierarchy may be used. At a first level, a user is prompted to enter (speak) his or her state. At a second level, the user is prompted to enter his or her city. At a third level, the user is prompted to enter his or her street. At a fourth level, the user is prompted to enter either his or her cross-street (if he or she is at an intersection) or the address on the street on which he or she is located (if he or she is on a block of the street). Based on the four pieces of information, a precise location may be determined for the user. In some embodiments, more or fewer levels in the hierarchy are used. For instance, a fifth level ("Country") could easily be added to the top of the hierarchy to enable the system for global locations.

An embodiment of the invention will now be described with reference to Figs. 3 and 4, ignoring optional steps 210 and 229. A data application, upon determining that an MU's location is needed, in step 201 transfers the MU from the data channel to a voice channel so that the user may provide his or her location using the inventive geocode process. In step 203, the present geographic level is set to the first level of the hierarchy, which in this instance is a

location's State. That is, the system will use a grammar file that only contains information corresponding to the states in the United States. The appropriate grammar file is loaded in step 205, as is a corresponding audible prompt for playback to the user. The audible prompt may be a prerecorded voice prompt or the like, such that when played back to the user, the user has an understanding of the information the user should then provide.

In step 207 the user is presented with the audible prompt to enter (speak) information. The user hears the audible prompt to enter (speak) the state in which he or she is located because the present level is set to State. The user's response is received and recorded in step 209. In step 211, the voice recognition software compares the user's response to the active grammar file (in this first instance, the State grammar file). The system makes a determination of whether the user's response matches an entry in the grammar file in step 213. If the user's response did not match an entry in the grammar file, the user is played an error message in step 215, and returned to step 207.

If the user's response was recognized in step 213, the system plays back an audible confirmation to the user, in step 217. The audible confirmation is an audio playback of what the system understood the user's response to be. This recording may be a speech synthesized audible message of the interpreted response. For instance, if the user speaks the phonetic sounds "âr-ũ-zo-nũ" in step 209, based on the user's speech the system may interpret the user's response to be the state of Arizona. The system looks up text corresponding to the user's response, such as "Arizona" or "State: Arizona," and processes the text using text-to-speech software for audible playback to the user.

In step 218 the user is prompted whether the confirmation was correct. This is because even though the speech was recognized within the grammar file, the speech may have been interpreted incorrectly. For instance, a user might have spoken the word "Arizona," while the system interpreted the response to be "Alabama" (due to the repeated 'a' sounds). The user can
5 detect that the response was incorrectly interpreted and notify the system of such in step 218. If the response was incorrectly interpreted, the system goes back to step 207 for re-entry.

If the response was correctly interpreted, the system proceeds to step 219, where a determination is made of whether the present level is the last level. That is, in a system with four levels (State, City, Street, Cross-street or Address), the system must proceed through four levels
10 of input. Because only the first level has been completed, the system will proceed to the next level in step 220. In step 220, the system advances the present level by one (e.g., state to city, city to street, street to cross-street/address), and proceeds to check whether the newly set level is the last level in step 221. If the newly loaded level is not the last level, then the system returns back to step 205. In the present example, the system will load the grammar file for cities in
15 Arizona, such as Phoenix, Tucson, Flagstaff, Scottsdale, and the like.

After completing the above iterations for the Street level, the system will advance to the last level, Address/Cross-street, in step 220, and determine that the present level is the last level in step 221. Upon making this determination, instead of proceeding to step 205, the system proceeds to step 222 where it loads an address grammar file in addition to the already loaded
20 Street grammar file. The Address grammar file is a grammar file containing information corresponding to the range of possible street addresses that the user may speak. That is, the Address file is not limited to the range of possible addresses for the recently selected street, but

rather it contains all possible numbers which may be provided as addresses. Thus, at this last level, the user may speak any street in the city or any address, not just cross streets or addresses within the range known to be on the selected street. This reduces the amount of individual grammar files that must be maintained.

5 In the present example, after the user selects the city Phoenix, the system will load a grammar file containing the streets located at least partially within the city of Phoenix, including A, B, C, D, E, F, G, H, I, and K streets as shown in Fig. 4. If the user next selects D street, the system will leave the street grammar file in memory, and also load an address number grammar file containing the range of possible addresses, for instance the numbers 1-99,999. Other address
10 sets are possible, such as different number ranges, letters for apartments or suites, half-step addresses such as 712 ½, and the like. The user may then select a cross street or an address within the two loaded grammar files.

After completing the above iterations for State, City, Street, and Cross-Street/Address, the system will determine, in step 219, that the present level is the last level. Upon such an
15 occurrence, the system will proceed to step 223 for geocoding.

Geocoding in step 223 includes accepting as input the user responses from each level of the hierarchy, and attempting to translate the state, city, street, and cross-street or address into a second form of location identifying data. Geocoding in this step may not always be successful. For instance, in the present example, if the user entered, at the last level, any of A, B, C, D, or E
20 streets, or any address outside the range 100 – 599 D Street, the geocode will be returned as invalid. It is during the geocoding process that the system checks the validity of the address or cross-street, and if valid, translates the user provided information into location identifying data.

The location identifying data may be coordinates of latitude and longitude with varying degrees of specificity. That is, depending on the accuracy of the system or the identified location, the location identifying data may be provided in degrees, degrees and minutes, or even degrees, minutes, and seconds.

5 The system determines, in step 225, If the geocode of step 223 is not valid. That is, the geocode may not be valid if the user provides, at the last response level, a cross-street that does not intersect the selected street. The geocode also may not be valid if the user provides, at the last level, an address that does not exist on the selected street. If the geocode is not valid, the system notifies the user, in step 227, that the system is unable to geocode the user's audible responses, and returns to step 207. In step 207, the user is prompted to reenter a cross-street or address. If the geocode was completed and is valid, the system updates the user's location in step 231. The data service previously being used before the voice-geocode process was started may then be resumed by the system and/or the user.

15 In one aspect of the invention, a grammar file specific to the selected street is loaded at the last level, thus negating the need for steps 221, 222, and 225. However, there is a tradeoff in that system performance may be reduced depending on the processing power of the data processing system being used to perform the database and grammar file manipulation. This is because the number of grammar files required to accommodate each street in each city in each state is quite large.

20 Data for each grammar file may be created using a database of valid street addresses, such as the United States Census Bureau's Topologically Integrated Geographic Encoding and Referencing (TIGER) database. A program may be used to parse the database and create

location specific grammar files, i.e., grammar files for possible responses at each level of the hierarchy, depending on the previous response when not at the top level.

It is possible that there are multiple matches within the grammar file. For instance, within a city, there may be a Main St. and a Main Ave. In such a case (not shown), the system
5 may prompt the user for clarification, using either audible responses or touch tone responses by the user.

In some embodiments a location may be determined based on the name of a landmark. The system may recognize a trigger response at any level, which would allow the user to simply speak the name of a landmark. For instance, if the user speaks the word "landmark," the system may be adapted to load a specific grammar file containing landmarks at the present hierarchical level instead of the default grammar file. That is, if after speaking the state "California" and the city "San Francisco," the system will load the grammar file corresponding to streets in San Francisco. However, if the user speaks the word "landmark" (or some other trigger word) the system may load a grammar file corresponding to landmarks in and around San Francisco, California. If the user then speaks "Golden Gate Bridge" the system may automatically proceed to geocoding based on the location of the spoken landmark, regardless of whether the user proceeded through every level of the hierarchy. The trigger word may be spoken at any level. Generally, the higher the level, the more well known the landmark should be to be included in the grammar file for that level. However, this is not necessarily the case, and is limited only by
20 system processing speed and capacity. Optionally, a trigger word is not required, and landmarks may be included within each grammar file.

Using the present invention, because the location information is provided by voice, a user is not required to enter his or her present location, but rather may speak any location. For instance, if a user is using a location-based service via his or her MU to receive travel information, the user may enter the location of the travel destination before the user gets there, thus enabling the user to receive information in advance of the anticipated travel. A user may use this information to find the location of hotel proximate to his/her final travel destination, in order to make hotel reservations. The present invention may also be used by phones equipped with GPS capability when the user desires to enter a location other than the MU's current location.

In another embodiment of the invention, with reference to Fig. 5, voice information may be used to authenticate a user before providing a predetermined service. Software for voice authentication that may be used is Nuance Verifier, commercially available from Nuance Communications in Menlo Park, California. To perform voice authentication, a voice passcode is used. That is, in a trusted environment where the user's identity is not questioned, the system prompts a user for a spoken word or phrase that is to be used as the passcode. The system stores this authentication information in a database. Thereafter, to authenticate the user, not only must the correct passcode be spoken, but the same user must speak it. These authentication procedures are performed within the voice authentication software.

When a data service determines that user authentication must be performed, a voice channel is initiated in step 301. The system plays an audio prompt over the voice channel, requesting that the user speak his or her passcode in step 303. The user responds by speaking into the mobile unit in step 305. The system, in step 307, compares the user's spoken response

to the user's authentication information to determine whether the speaker is actually who he or she claims to be. The system determines whether the user is authenticated in step 309, i.e., the speaker's response matches the passcode and the speaker's voice is the same voice used to create the passcode.

5 If the user is not authenticated, the system checks to determine whether the user has three failed attempts in step 310. Other numbers of attempts may be used. If the user has not yet attempted voice authentication three times, the system returns to step 303 and again prompts the user to speak his or her passcode. If the user has unsuccessfully attempted voice authentication three times, the system proceeds to step 312 where the user is informed that voice authentication was unsuccessful. The system then proceeds to step 313. If the user is authenticated in step 309, the system proceeds to step 311 and plays back a message through the mobile unit, informing the user that voice authentication was successful. Steps 311 and 312 are optional. In step 313 the system terminates the voice channel. The system sends the authentication results to the data service in step 315.

10 In another embodiment of the invention (not shown), the voice authentication is performed based on the user's voice, and not on a passcode. That is, the system may analyze the user's voice to determine whether the user is who they claim to be, based on the predetermined authentication information for an individual.

15 In an embodiment of the invention, shown in Fig. 3 including optional steps 210 and 229, only an authenticated user of a mobile unit may update the MU's location using the voice-geocode process. After each iteration of step 209, the system (in step 210) copies the user's spoken response to a voice authentication engine. The voice authentication engine used in this

embodiment does not require a user passcode for voice authentication, but rather authenticates a user based on the user's voice.

While the voice-geocode process is operating, the voice authentication engine analyzes the user's spoken responses from step 209 against predetermined authentication information for an individual, such as the owner of record of the MU, in order to determine whether the user is authorized to update the MU's location. After the voice-geocoder has obtained a valid geocode in step 225, the system checks to determine whether the user was authenticated in step 229. If the user was authenticated by the voice authentication engine, the system updates the MU location in step 231. However, if the user was not authenticated, the MU location is not updated. Optionally (not shown), the user may receive an indication that the location will not be updated because the user could not be authenticated.

While the invention has been described with respect to specific examples including presently preferred modes of carrying out the invention, those skilled in the art will appreciate that there are numerous variations and permutations of the above described systems and techniques that fall within the spirit and scope of the invention as set forth in the appended claims.